ON "ESSENTIAL HÆMATURIA" AND "NEPHRALGIA."

WITH REMARKS ON THE TECHNIC OF NEPHROTOMY.*

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THE group of cases called "essential hæmaturia," "nephralgia," and "hæmaturic colic" may be classed among the border-line problems between medicine and surgery. The name insinuates, in the adjective "essential," that we have no palpable anatomic or histologic findings. Later investigations have, however, shown that microscopic changes (often only minor) existed in some cases, and therefore also the synonym "pseudo-essential." For the sake of brevity I shall not consider the hæmaturia which occurs more or less periodically in children, where it was drawn into parallel with epistaxis, nor those cases due probably to some kinking in floating kidney, nor the hæmaturias in hydronephrosis or during pregnancy and lactation, nor the real hæmophilia cases.

I propose to give some personal observations where even etiological factors like these mentioned were missing. After such a kidney is split open in a case of severe repeated renal colic or long-lasting hæmaturia, and nothing is found on or in the kidney, its pelvis, and the ureter, a certain degree of uneasiness remains in the mind of the operator: "Have I not overlooked something?" We cannot examine the kidney in every corner; we may examine the fatty and fibrous capsule, split the kidney from pole to pole, examine its cut surface, feel its consistency, cut down into the pelvis, which should always be palpated first while the kidney is yet *in situ,* so as not to dislodge any possible stone in the manipulations necessary for bringing the kidney to the surface; we may inspect the pelvis, feel the calices and the papillæ protruding into them; we may get a good view of a number of them, probe the ureter to the bladder—and all this was done in every one of my cases—but still we have not seen every corner and we may have overlooked this or that; be it a small concrement, be it a small tubercular ulceration on a papilla, be it a small neoplasm, or a tiny varicosity on a venule near a papilla. A general hemorrhagic diathesis we are of course supposed to have considered beforehand with the anamnesis.

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By all means it is necessary that such cases be followed not only for some time but for a very long time after the operation, before we positively pronounce them or especially publish them as the one or the other. In this way cases of overlooked stones, tuberculosis, or neoplasms will be excluded with the greatest possible probability.

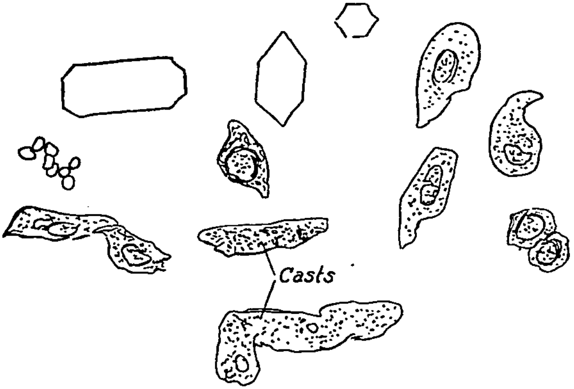
I intend to report in this paper five cases observed, now, from four and a half to six years after operation. The last two of these cases I have mainly added for comparison of the microscopic changes in the kidneys, as in one the symptoms were perhaps and in the other with certainty due to a ureteral stone. From all these kidneys I have microscopic sections which were obtained by removing a piece 4 to 5 millimetres thick, and about the surface of a thumb-nail. The specimens were not handled in any way but dropped into alcohol from the knife blade that removed them. The sections were taken from the interior of the removed pieces, so as not to have any admixture of blood.

CASE I.—Mr. A. R., of Winona, 40 years of age, of robust build, very moderate in his habits, working in a factory, came to me on September 1, 1902. He gave the following history: He had typhoid fever when five years old: was never sick since with exception of the grippe, which he had about ten years ago, and some rheumatism with fever five years ago. He is working in a fibre factory. No aniline (known to produce bladder cancers) is used, but other chemicals, which he cannot exactly describe.

About three weeks ago he noticed for the first time blood in his urine, which was quite profuse. He had no pains to speak of. Six or eight weeks ago he hurt his back by lifting a log; this is all that he could accuse. A few days ago he had a little queer sensation above McBurney's point; he would, however, hardly call it a pain.

I examined the patient in my office and find the following notes: Everything normal with exception of the urine, which contains small quantities of blood and apparently hardly more albumin than due to the blood. Bladder (per rectum and with sound) appears normal. The lower pole of the right kidney is a little sensitive on palpation; nothing abnormal, however, to be felt.

FIG. 1.



CASE. I. Second urination after the nephrotomy. Urinary sediment.

As the bleeding remained quite constant notwithstanding feeding on gelatin, etc., and, before all, as the bleeding became more marked notwithstanding rest in bed for two weeks, I decided to explore the kidney, after the blood had been found to come from the right side only, and this with Harris's segregator at two examinations two days apart.

At both times it appeared that the right side was more abundantly secreting than the left one, as 3:2. The urine from the left kidney showed a trace of albumin, and was 1019 sp. gr. The urine from the right side was also 1019 sp. gr.

On September 16 I laid the kidney bare and brought it to the surface after removing a part of the twelfth rib. The kidney was somewhat enlarged, its consistency seemed about normal. Freeing the kidney out of its bed was not abnormally difficult. Digital compression of the renal artery. Incision from pole to pole according to Zondek about 8 mm. behind the largest convexity. The poles were not entirely split. Pelvis opened, explored, and sounded. No changes found. The kidney substance appeared normal. Excision of a piece for microscopic examination. Suture of the kidney with six or seven deep catgut sutures, running from the surface to the medulla. About three superficial catgut sutures where it bled. Gauze strip down to the kidney after its reposition. Closure of the wound up to this drainage strip. Anæsthesia, as in all other cases: ether with a previous hypodermic of morphine ¼ gr. and atropine $^1/_{100}$ gr. Patient stood the operation very well. After three days gauze drain removed, no urine was noticed to come from the wound. The urine had been very bloody after the operation and microscopically had shown large quantities of blood-corpuscles, kidney cells and some tube casts (see Fig. 1). On September 20 (four days after the operation) the urine was, however, beautifully clear, had no reddish tinge, but showed a trace of albumin. Specific gravity 1016. The patient declares that the urine was at no time as clear as this since the first beginning of his trouble. He left the hospital for his home fourteen days after the operation. The patient remained perfectly well, is now (October, 1908) looking very vigorous, and the urine, which is free from albumin and sugar, has a specific gravity of 1024 and has remained entirely clear up to now—six years after the operation.

Case II.—Mr. A. F., of Havre, Montana, 36 years old, of robust appearance, very moderate in all his habits, railroad office employee, came to me on November 9, 1902.

The intelligent and well educated patient had observed himself very carefully. While there was nothing in his previous history which could have any bearing on his kidney trouble, he woke up one morning in May, 1902, with a dull pain in the region of his right kidney, which became excruciating. There was also an irritation to urinate. The pains lasted thirty-six to forty hours with intermission of one or two hours. The second day the pains grew weaker and rarer. There occurred, however about one and a half to two hours apart, two attacks, which lasted forty to sixty minutes as an excruciating, steady pain. The pain started directly over the crista ilii just outside the erector spinæ. Shortly before these and also before the later attacks of pains the patient always had a bad sensation in his mouth, as though from a spoiled egg. This sensation lasted about one minute and then the pains would start. After the pain in the kidney has lasted ten to fifteen seconds, it travels along the course of the ureter down to about McBurney's point. It takes about ten to fifteen seconds to travel down to this point, and then it usually remains here the same length of time. After this it goes slowly farther down, and this is accompanied by a decrease of the pains. When it then reaches the linea innominata, relief comes; but a burning in the bladder persists for some time. Patient usually had no pains in the night, but only after he got up in the morning. *The first attack came on after a sharp ten hours' ride on horseback.*

On September 20, 1902, a second attack occurred after jumping down from a platform. This attack lasted four hours and consisted of about three separate spells. It passed over without morphine, which had been necessary at the attack in May. After this attack there remained for several days a sensation of pressure as though from outside against the loins. Immediately before the attack he had felt languid, but had an unusual appetite.

The urine at these attacks was brown, turbid, thick, like turbid weak coffee. On the 16th of October he wrote me these data and added that he did not feel well at all. He suffered the last few days continually from dull pains in the kidneys and from a very disagreeable sleepiness and dizziness. He then used for several days rest in bed, milk diet with some bread, and much distilled water. Soon after the patient had again the premonitory bad taste in his mouth, which comes on suddenly, and is always accompanied by a brown urine. This sensation appeared fifteen to twenty times a day for about two weeks up to the time of my first examination.

The examination of the patient on November 9, 1902, gave healthy conditions with exception of the right kidney, which was sensitive on pressure, and the findings in the urine. The kidney could not be palpated in the rather fleshy robust man. Segregation of the urine with Harris's instrument on November 10. From the left side we had a clear, straw-colored urine, slightly alkaline in reaction, 1018 sp. gr., with no trace of albumin. On the right side the urine was turbid, alkaline, 1019 sp. gr., containing a very small quantity of albumin. During the time that 100 drops were counted coming from the left side, there came only 67 from the right one.

The turbidity of the urine of the right side was due to red blood-corpuscles and to a great many epithelia. It is probable that at least part of the blood came principally from a slight injury by the segregator to the bladder mucosa, a fine fresh coagulum being found on the catheter when removing the instrument.

Operation on November 12, 1902. As the ribs came very far down and as the kidney appeared therefore far up under the border, I removed a good portion of the twelfth rib. It then happened, after the rib was away, that in further freeing the parts a tear of about 3 cm. occurred into the pleura, promptly followed by a noise produced by the sudden entrance of air. The opening was at once closed by compression. The patient, who was never kept very deeply under the influence of the anæsthetic, felt probably some pain from squeezing his pleura so firmly and began to moan and press. Of this we made use by allowing some air to escape during the moments of forcible pressing of the patient, and I am sure it did good service. A continuous catgut suture closed the opening firmly. There arose, as you would expect, no trouble afterward from this opening of the pleura.

It was more difficult than usually to free the fatty capsule away from the kidney on account of many fibrous bands, which, though fine, were quite firm. Nevertheless all the freeing could be done by the hand and fingers without a cutting instrument. Palpation of the pelvis and of the kidney gave a negative result. The organ was then brought up upon the body surface. Digital compression of the renal artery. The kidney was incised as in the former case; nothing was found. The pelvis was probed in every direction and a ureteral catheter was introduced. A small piece was removed for microscopic examination and then the kidney was sewed up entirely with six figure "8" catgut sutures. The deep loop of these sutures included the larger vessels at the junction of cortex and medulla (arteriæ et venæ arciformes). Besides this two or three simple superficial sutures. A small gauze drain was introduced to the replaced kidney and the rest of the wound closed.

There was at no time urine noticed in the dressings. No hard pains followed the operation. The urine contained great quantities of blood at first after the operation, but cleared up after a few days. Three weeks after the operation the patient came to my office, feeling quite well. The urine was entirely clear. There was only a very small trace of albumin in the morning urine, while the urine passed during the day did not contain any with the nitric acid or the Esbach tests. The abnormal sensation of taste never occurred after the operation.

On December 12, 1904—two years after the operation—I made the following notes: Urine entirely clear; no trace of albumin; specific gravity 1018. Patient is the picture of health. He says he feels very well and never had the slightest trouble since he left the hospital. This result has remained the same up to August, 1908, when I last heard from him.

CASE III.—Mr. O. S. Sh., of Wells, Minn., farmer, 32 years of age, of temperate habits, tall, of good physique, came to me on January 3, 1903. He had always been well up to November 20, 1902, when he noticed a very bloody urine, though he had no pains. This condition remained quite constant up to the time of my examination (a little over six weeks in all), with exception of three free intervals of about twenty-four hours each. He was under careful medical attention; never had any pains. Appearance of all organs normal. Kidney was not sensitive, nor to be outlined distinctly. However, urine dark, bloody. Bladder normal. Harris's segregator gave entirely clear urine from the left kidney with only a small trace of albumin.

The right kidney gave the same quantity of urine as the left, but the urine from the right side was very bloody. It did not contain more albumin than in my estimation corresponding with the blood, 1¼ per thousand with the Esbach test. Microscopically nothing but blood-cells.

On January 7, 1903, incision into the kidney. Opening of the pelvis in the upper and lower main spaces. Papillæ as completely as possible explored. Nothing abnormal. The cortex appeared somewhat large; its color about normal. Excision of a piece and complete closure of the kidney wound with four figure "8" and two simple superficial catgut sutures.

The striking feature in this case was that from the adipose capsule, which was rather poorer in fat than normally, there were numerous strong bands running from all sides toward the fibrous capsula propria. These bands were so firm that I had used them to dislocate the kidney upon the surface. These adhesions were found at all parts of the surface of the kidney and were quite solid; though only fine lamellæ, some had to be cut with the scissors.

Mr. Sh. continued to pass very bloody urine for about one week; then the quantities of blood became more moderate though yet quite considerable. There had at no time been urine in the dressings in a noticeable quantity. Patient left the hospital on January 17, ten days after the operation. Continuance of the bleeding after the operation had made me think that perhaps the other kidney was now bleeding. An examination with Harris's segregator, however, showed the blood to come—as before—from the right side. On February 16 the patient wrote me that he felt as strong as ever. In a sample of his quite bloody urine we found kidney-cells besides the blood, no casts. Probably as much blood as before the operation. The patient writes, however, that, while he had passed some clots of blood before the operation, he did not pass any since coming home.

The result in this case up to that time was very small, with the exception that we knew that there existed with all reasonable probability no condition which was neglected by waiting. Stone, neoplasm, or a recognizable degree of tuberculosis was excluded. This in itself is an important gain in such a case. So we waited. The blood very gradually decreased in the course of one year, until the urine was finally free from blood by January, 1904.

In September, 1908, I heard from him upon writing him. He is apparently quite well and free from any symptoms of kidney trouble.

The next case doubtful in our mind at the time of the operation proved to be one of an overlooked ureteral stone, but I will mention it here in full, because the comparison of the clinical history and of the macroscopic and microscopic changes in the kidney is of importance for some points which I want to emphasize.

Case IV.—Mr. F. B., railroad engineer, 35 years of age, very robust, of strict habits, was kindly referred to me by Dr. Eshelby of St. Paul, on January 29, 1903.

Mr. B. had never been seriously sick up to eight weeks before that date, when, while oiling his engine just before starting for his daily trip, he noticed a sudden dull pain in the right iliac region. He nevertheless tried to run his engine, but in twenty minutes the pains had become so excruciating that he had to give up. Morphine then eased the pains and for two or three days a very marked soreness persisted. From the anterior part of the crista ilii the pain went toward the lower inguinal region. There were never any pains toward the testicle or bladder at that time. Dr. Eshelby found microscopically some blood in the urine at the time of the attack, but no casts. After the mentioned two or three days of very marked soreness were over, there remained a pain of moderate intensity for two weeks over the right kidney. Another severe attack of pain occurred about a month later and a third one on the day previous to my examination, after his urine had been very dark and bloody for one week.

In all three attacks the patient vomited frequently. At the second attack the pains had gone toward the testicle. At no attack was there tendency to frequent urination.

The examination revealed besides quite normal other organs a sharp pain in the back and in the testicle on the right side. Objectively nothing was to be made out on the fleshy and very strong man. The urine was very bloody, almost black, turbid. Microscopically nothing but blood.

On February 3 we operated upon the man, though the urine had materially cleared up the day before. Kidney exposed and opened as in the other cases. The fatty capsule was very bulky. The kidney was abnormally large, the largest of these four cases; of normal consistency, lobulated. Palpation of the pelvis *in situ* negative. Incision of kidney. Pelvis explored and ureter sounded with a spiral metal probe, which did not encounter any resistance, though it gave once a peculiar sensation, when introduced low down into the ureter. This was, however, unfortunately judged not to come from any solid mass. The conic-shaped cut surface belonging to *two lobules in the middle portion of the kidney* were from the cortex to the papillæ *much darker than the rest of the kidney* and appeared hemorrhagically infarcted. The dark color remained notwithstanding the free incision through these parts. The rest of, the kidney looked normal. The pelvis was inspected and all its parts exactly explored. While all the papillæ appeared normal, the *mucosa of the pelvis showed rather numerous minute hemorrhagic spots.*

Excision of a piece partly through the dark area. Kidney united with six interrupted figure "8" catgut sutures. The rubber tube was then removed; no bleeding. No urine noticed in the dressings at any time.

The patient was allowed to be out of bed ten days after the operation. His urine, which it must be remembered had started to clear up the day before the operation, was again quite clear after four days. The patient felt excellent and left the hospital thirteen days after the operation. On that day he stated that ever since the first attack there was even at the best of times some soreness in the right side, but that now he felt entirely well. This I only mention to show the fallacy of too early reports of such cases.

To make the story short; good times and attacks of pains then changed off; at times the free intervals lasted several months, in which he was as well as he could wish to be. After repeated attacks a stone was passed on October 6, 1905, and with this all the symptoms ceased. He remained well up to my last interview on October 1, 1908. The urine was clear, 1020 sp. gr., free from albumin.

The fifth and last case to be reported is one of a rather profuse bleeding following—as it seemed probable to us—the passing of a stone from the ureter into the bladder a few days previous to my first examination.

Case V.—Mr. G. H. W., 27 years old, railroad man, was seen by me on March 21, 1904, in consultation with Dr. Geer. While the patient claimed never to have been sick before, the present trouble started in November, 1903, with a very severe colicky attack of pain under the right ribs. He vomited after morphine. First he had the sensation that the urine wanted to come, after this the bowels wanted to move, and then the strong pain appeared. It lasted about two days and after that there remained a slight soreness. He was five days in bed. The second attack of again very severe pain occurred on February 20, 1904, and lasted twenty hours. Third attack, the severest of all, was on February 25. The pain was for three days atrocious. Then something seemed to slip into the head of the penis, which made him yell from pain. This happened while he was lying on his back quietly and not, as one might think, while urinating. After this the pain ceased. He was not aware of having since then passed a stone in urinating. The urine contained blood, which remained very abundant after the pain had ceased. This was the reason that on March 2 I laid the right kidney bare. It was congested and about one-half larger than normal. Its fatty capsule was dense and adherent, so that in freeing the kidney from its fat a part of the fibrous capsule of the kidney was stripped off. Kidney split longitudinally down to pelvis. Ureter catheterized. No stone to be found. The parenchyma appeared fairly normal except for the congestion. A deep layer of catgut sutures to secure the larger vessels and a superficial one. Fearing some strangulation of the kidney parenchyma after the suturing, the fibrous capsule was split on the anterior and posterior surface. Nine days after the operation there were only a few blood-cells to be found in the urine. The patient left the hospital two weeks after the operation and came to my office another week later (March 23) feeling fine. One year after the operation the urine was normal and the patient felt well. Dr. Geer had the courtesy to examine the patient for me in September, 1908, and reported him as well. His urine was free from albumin; 1018 sp. gr. He had at no time had any signs of his former trouble.

Histology of the Five Pieces Removed from These Kidneys.—The specimens were all stained with hæmatoxylin and eosin or Van Giesen's stain.

Case I.—This case had simple renal hæmaturia of five and a half weeks' duration and no pains except slight ones on palpation of the kidney.

The majority of the *glomeruli* show in their capsules some granular masses, which often fill large spaces between the glomerulus and its capsule, and form crescent-shaped granular areas with here and there a recognizable red blood-corpuscle or some detached and disintegrated epithelial cell in them. These epithelial cells, though not very numerous and very rarely as many as eight or ten in a section of a glomerulus, are distinct. They seem to come from the glomerular epithelium, as the capsule with its flat, sharply-stained cells looks quite normal, while in some few places (though not very commonly) the superficial glomerular capillaries are poor in nuclei and appear like hyaline tubes with only comparatively few (endothelial) nuclei. The detached cell-bodies, which only take a diffuse stain, and which sometimes are ready to change into granular heaps, are therefore in my estimation *desquamated glomerular epithelia.*

FIG. 2.

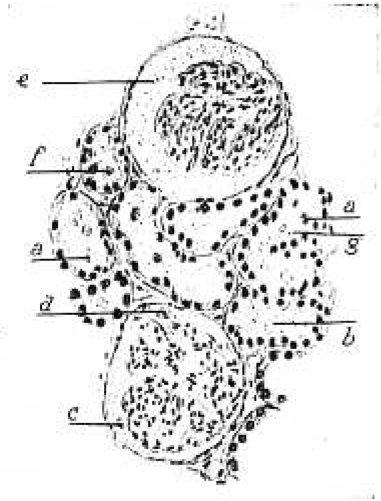


FIG. 3.

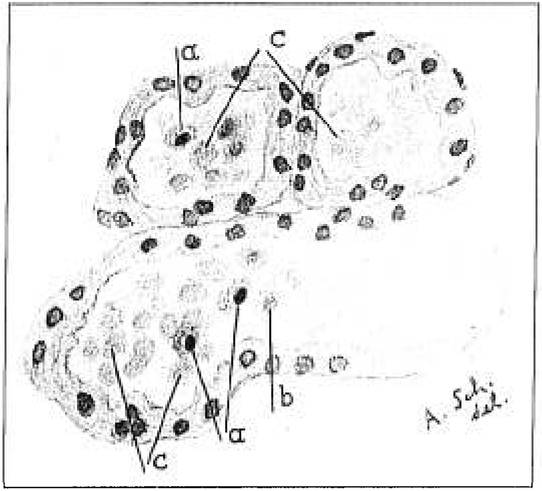


FIG. 2. CASE II.—*a*, disintegrated epithelial cells in convoluted tubules; *b*, amorphous detritus in convoluted tubules; *c*, red blood-corpuscle in Bowman's capsule, which is, however, a rare appearance; *d*, disintegrated epithelial cells (glomerulus-epithelia) in Bowman's capsule (these cells are in other places more numerous, 5 or 6 in one spot); *e*, amorphous detritus or precipitate in Bowman's capsule, in many places taking up considerable room; *f*, detached fresh epithelial cell in a convoluted tubule; *g*, red blood-corpuscles in convoluted tubules.

FIG. 3. CASE II.—Convoluted tubules with a flattened, sharply outlined epithelium and well staining nuclei. The protoplasm is finely granular, does not show any fatty degeneration. In the lumen there are large quantities of cellular bodies in different degrees of disintegration: *a*, with well stained nucleus; *b*, unstained but recognizable nucleus; *c*, nucleus gone. (The reproduction of the original drawing is not very good.) The tubules, as seen here, are *typical for the whole section;* in some places they contain fresh blood-corpuscles; that is, however, rather rare. The glomeruli contain sometimes granular detritus and a few epithelial cells in the capsule, others are quite normal. The large majority of the convoluted tubules show, however, cellular masses, distinctly desquamated epithelium. They appear distended by these contents. Capillaries in many places distended, in others normal. Capillaries in glomeruli often distended with blood.

Fig. 4.

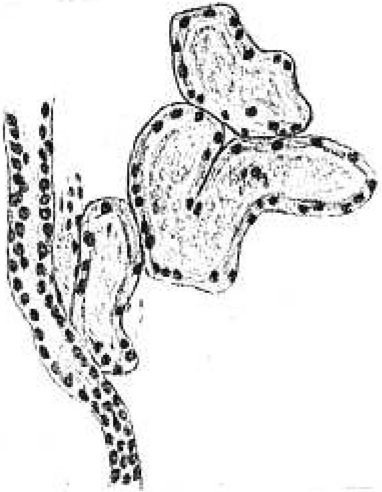


Fig. 5.

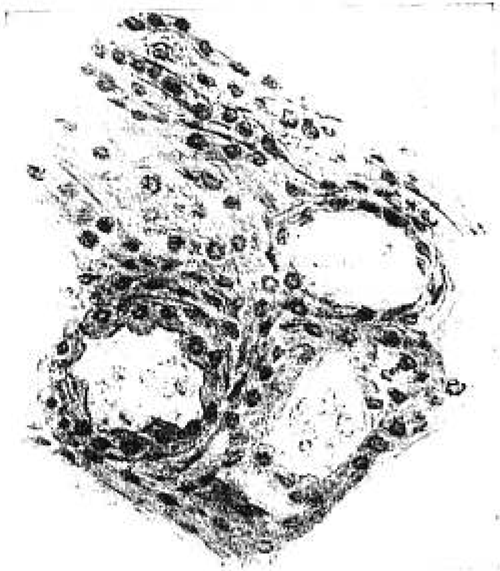


Fig. 4. Case II.—The convoluted tubules are filled with disintegrated epithelial cells, which are packed together and form cast-like solid masses, while the epithelium is stretched and lowered, with nuclei all well stained and the protoplasm sharply outlined, well stained with eosin, showing no fatty degeneration. The distances between the nuclei are great, showing the stretching of the wall of the tubules. No interstitial changes. In some places the blood-vessels (capillaries) are distended with blood to their maximum, in other places without changes. The capillaries of the glomeruli are mostly distended with blood to an abnormal degree; in some places there are no signs of any anomaly. In the hyperæmic glomeruli there are (though few in comparison with the convoluted tubules) detached fresh and disintegrated epithelia and granular masses. Henle's loops also contain granular masses in many places.

Fig. 5. Case III.—Simple painless hæmaturia. The convoluted tubules contain a very moderate amount of epithelial cells, but much blood and blood detritus, though hardly to be seen in this section (Glomeruli normal in this case. Much blood in Henle's loops and the straight tubules.)

FIG. 6.

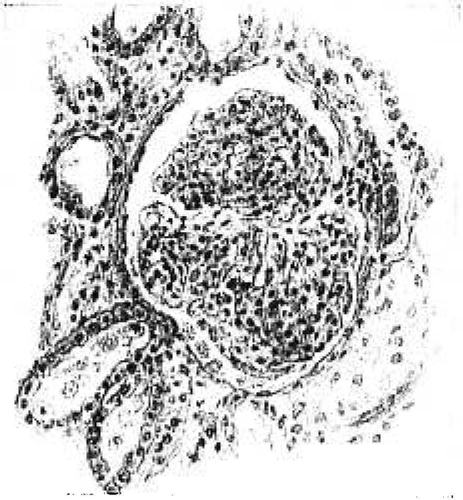


FIG. 7.

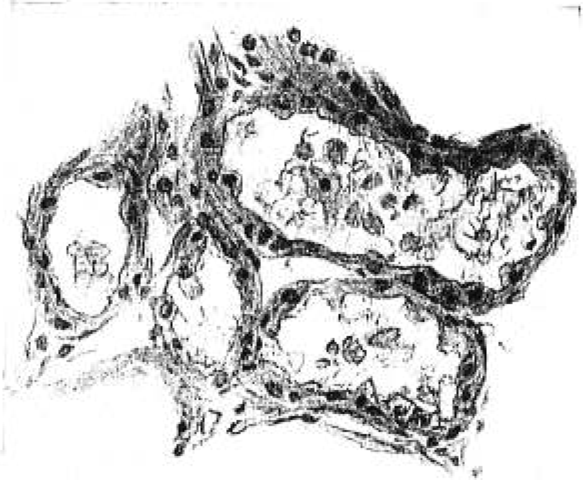
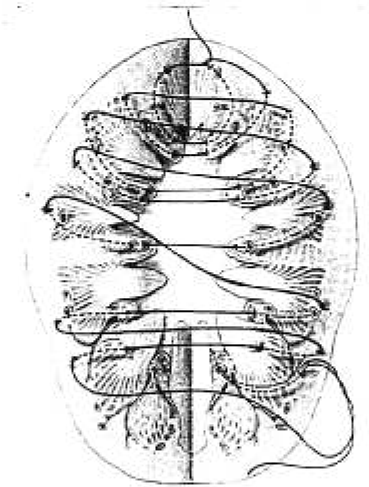


FIG. 6. CASE IV.—Ureteral stone colic. In the glomerulus there are several granular detached epithelial cells with nuclei unstained or only slightly taking the stain. Glomerular capsule normal. (In some other glomeruli red blood-corpuscles were found and amorphous granular deposits.) Proximal convoluted tubules containing desquamated epithelia and granular débris. Interstitial tissue normal.

FIG. 7. CASE V.—Profuse hæmaturia (probably following a ureteral obstruction which was suddenly spontaneously relieved). Convoluted tubules distended, epithelium stretched and flattened. They contain fibrin threads, blood-corpuscles, and detached epithelial cells whose nuclei do not take the stain any more. Interstitial tissue normal.

FIG. 8.



Catgut suturing of the kidney, grasping the large blood-vessels of the areolar tissue between each two papillæ (branches of the arteriæ interlobares) and also the arteriæ arciformes, found between medulla and cortex. Because the bleeding into the pelvis is the most important, as it distends the kidney and loosens the sutures, in a severe case of hemorrhage the layer nearest the calices might preferably be first sutured separately and firmly.

The *convoluted tubules* show almost uniformly an abnormal content, though the quantity varies. You see detached, easily recognizable, very granular epithelial cells in different stages of preservation from the few freshly detached cells with a well stained nucleus of the shape, size, and staining qualities of the lining cells of these tubules, down to the much more common forms of dilapidated cell-bodies ready to fall into granular *débris*. In some places as a stage of transition you can recognize a nucleus by its form, but it is unstained. The remainder of the lumen of the tubules is more or less filled with amorphous granula. How much they represent disintegrated blood is not to be made out in these specimens. The lining of the tubules is well stained; there is no fatty degeneration. The cell protoplasm takes a rather uniform good eosin stain. In some places the tubules are free from abnormal contents; their high epithelium with the conic free ends is beautiful. In some convoluted tubules there are red blood-corpuscles, but never in larger masses.

Henle's loops and the tubuli recti give normal pictures; here and there we find some little granular or bloody content in their lumen, but comparatively very little. *The interstitial tissue* in general is normal. Between the tubules the stroma is very small and tender. In no place are there indurative or sclerotic changes. There is no increase in nuclei anywhere in the large section except, however, *in one place,* where there is a rather dense *infiltration of round cells* over an area a little larger than the size of a glomerulus. An obliterated glomerulus is at the side of this. In a few places there are hemorrhages into the interstitial tissue. The contours of these extravasations are shaped according to the adjoining tubules. In one place there is an adjoining convoluted tubule, whose nuclei and protoplasm have taken a deep eosin stain and into whose lumen extravasated blood appears to be continuing.

The *blood-vessels* do not show any anomalies. In looking back over the case we are struck by the absence of *diffuse* interstitial inflammatory changes, notwithstanding the alterations in the epithelium, consisting of a desquamative process mainly in the convoluted tubules and also in the glomeruli, together with bleeding into the latter. One might be tempted to speak of a diffuse nephritic process, say a very mild degree of it; nevertheless outspoken inflammatory signs are missing, and the complete cessation of all the clinical symptoms, including the absolutely normal condition of the urine six years later, gives it a character different from what we commonly consider under nephritis. The area of leucocyte infiltration and the obliterated glomerulus, it is true, may indicate a minute embolic infective condition and the fibrous perinephritis could be thought to be the consequence of this.

CASE II.—This case had severe renal colics at long intervals and turbid, coffee-like urine at the time of the operation.

The *glomeruli* are as a rule normal in appearance, except that a number of them have a granular deposit along the capsule, though never as marked as in the former case. No recognizable detached cells or blood-corpuscles within the capsules. As a whole the glomeruli are rather free from changes.

The proximal *convoluted tubules* show a marked distention; their lumina are comparatively wide, the nuclei of the epithelia are farther apart than normally, and the cell protoplasm, which is well and somewhat uniformly stained with eosin, is low. There are only a few convoluted tubules which are not containing desquamated cells. These tubules are smaller and have an epithelium of the normal high, conic shape. They are probably distal convoluted tubules. As only very rarely there is anything abnormal to be seen in a *Henle's loop*, it speaks for a retention of these cellular masses in the convoluted tubules, where the desquamation must have occurred in the main. All transitions in the desquamated cells are to be noticed: a few freshly detached cells with good nuclear stain and of the character of the lining of the convoluted tubules; then very large quantities of disintegrated cells partly with a sharp outline, partly forming only a coherent granular mass. As Fig. 3 shows, this cell detritus is in some places so tightly packed that it is formed into a more or less uniform-looking compact granular mass.

The *blood-vessels* and the *interstitial tissue* appear entirely normal.

Looking at Case II now after nearly six years of perfect freedom from pain and urinary or any other symptoms, we get much more of a bird's eye view of the whole, if I may say so. A congestion of the kidney, peracute after the ten hours' ride, seems to have been the cause; or, perhaps better, one of the causative factors for the first attack, and this first attack may have left a vulnerability of the kidney which caused the second attack after a mere jump from a platform. That a nervous element may have been added to the case is probable, if we remember the abnormal gustatory symptoms, which preceded every attack with greatest regularity. We know that the kidney function is under very powerful control of the nervous system, so much so that, for instance—as you all know—traumatism to one kidney can completely inhibit the function of the other. I might add to the history of the case that our patient had been pathologically nervous a few years previous to the kidney affection. Perhaps the trauma was the main cause, a mild fibrous perinephritis added its share, and a prolonged retention of desquamated material afterward might have left a tendency to further attacks of undue congestion.

Case III.—This was characterized by constant and profuse renal hæmaturia for about seven weeks, not to be influenced in any way by medical treatment and care, with no pains of any kind. The firm adhesive bands around the kidney ought to be remembered.

The striking feature of the microscopic picture and the marked difference from the other cases is the large quantity of blood and blood detritus in the *convoluted tubules*. There is only a slight desquamation of epithelial cells. We see large quantities of blood in *Henle's loops*, and the straight tubules with enlarged blood-vessels between them. These pictures explain the origin of the blood in the urine. The *glomeruli* appear normal. The convoluted tubules besides their bloody contents are otherwise normal. There are no casts. Besides the mentioned hyperæmic blood-vessels there are no changes in the interstitial tissue, no infiltration, no thickening, no exudates.

We have here a mild old perinephritic process forming band-shaped adhesions, and we have very little more than a hyperæmic kidney, with extravasation of blood into the tubules. Nephrotomy revealed nothing further. The history of the case gave no clue either. The only factor remaining was that we had to do with a robust man of a hard-working class. Did the perinephritis, the very cold winter weather, and hard work combine their effects to bring on this condition? For a correct sizing up of the case it is necessary to be able to exclude other causes by a long observation after the operation. The patient remained well for now nearly six years with no signs of a nephritis, or of stone, of tuberculosis, or tumor, or any other abnormal condition.

Case IV.—This case had severe colics due to a ureteral stone, and very bloody urine up to the day before the operation.

Glomeruli.—In some we found a number of granular, detached, disintegrated epithelial cells, while the capsule was quite normal and also its flat epithelium. Besides this we had in some glomeruli red blood-corpuscles, and some amorphous granular deposits. These changes are, however, little marked; the majority of the glomeruli appear normal, and where these abnormal capsular contents exist, they do not take up nearly as much space as for instance in Case I. I found *two obliterated glomeruli.*

The *tubuli contorti* contain desquamated epithelia and granular masses, mostly found loosely spread in the tubules. Sometimes, however rarely, these granular *débris* show their origin from epithelial cells, being grouped into well outlined masses of the size and shape of the epithelial cells; or they form a more solid mass in the tubules, though one could hardly call it a coherent cast. Among this amorphous material there are recognizable red blood-cells, which make it probable that a great part of the detritus is also of hemorrhagic origin. In some tubules blood is found in larger quantities.

Henle's loops and the straight tubules appear normal. The *interstitial tissue* is also quite normal, with the exception of one focus of marked leucocyte infiltration. It has the size of about two glomeruli. No hemorrhages into the tissues. It is of interest that after the stone was passed many months later, the urine remained clear. At the last examination, in October, 1908 (five years and nine months after the operation), it contained no trace of albumin and had a specific gravity of 1020.

Is it not interesting to find in this case of a stone the very identical changes in the parenchyma as in the former " essential " forms? Does it not lead one to feel that the desquamation is mainly the *result* of a retention or congestion? In examining my cases over again I could not refrain from the thought that perhaps some of the reported " essential " cases, declared later on to be microscopically glomerulonephritis, were nothing else than pictures as we saw them, perhaps some of them more outspoken. Then a number of these somewhat magic cases of mild and even chronic " nephritis " with their very severe colics would have to be looked at in another light; the changes found by the microscope would then not be cause but consequence, and the *primum movens* would be a congestion or stasis (active or passive hyperæmia) of different origin.

Another point is brought out by this case. This specimen shows us the kidney as it looks during an attack of ureteral stone colic. The blood does not come from an abrasion as one might perhaps think, nor does it mainly come from the mucosa of an overdistended pelvis; but it comes to the greatest extent *diffusely from the kidney parenchyma, the tubuli, and even the glomeruli,* and following this thread further it is now nothing miraculous that in a case of ureteral difficulty we should find an obliterated glomerulus or a few small foci of leucocytes. This is the way we finally—far in end—come to the cirrhosed, fibrous, stone kidney.

Then, in some of the reported nephritic " pseudo-essential " cases, should not the disseminated alterations in the parenchyma or stroma be due to an overlooked ureteral difficulty?

How easily such a condition could escape the observer, I think is shown by the next case, where the exploration was entirely negative, though the history of the case made it probable that a ureteral stone (or perhaps a blood coagulum?) produced the colic.

CASE V.—Operated upon probably a few days after a ureteral stone had slipped into the bladder. The microscopic examination of the small piece removed shows the *glomeruli* proper and their capsules to be normal in structure. In the capsular spaces are frequently seen blood-corpuscles and masses of fibrin, adherent partly to the capsule, partly to the capillary loops. In some glomeruli the blood clots are bulky, in others we see only traces of blood and fibrin. Hardly any desquamation. *Convoluted tubules* distended; epithelium flat, as if drawn out. Almost all the convoluted tubules are filled with fibrin, blood, and desquamated epithelia that have lost the nuclear stain. These latter seem packed into casts in places. *Henle's loops* partly contain fibrin and at times show irregular arrangement of the epithelial lining, pointing toward some desquamation. *Tubuli recti* partly containing fibrin. *Interstitial tissue* normal; no infiltration or thickening.

In summing up the findings in our cases briefly, we see that, macroscopically, there were strong perinephritic bands in Case III, with his seven weeks' painless hæmaturia, and the same, though not quite to such an extent, in Case II, with the renal colic. In Case IV, of ureteral stone, we found an infarcted area comprising two lobules and we also had numerous minute hemorrhages in the mucosa of the kidney pelvis. Otherwise all the five kidneys appeared normal, except that they were more or less enlarged.

Microscopically, the most striking thing was the *lack of any diffuse changes in the interstitial tissue.* The *glomeruli* show more or less extravasated blood in the capsular spaces and some desquamation of glomerular epithelia. In Case III (simple hæmaturia) this was even lacking. No glomerulonephritis, no thickening of Bowman's capsule. The main changes in all the five cases are found in the *tubuli contorti.* They are for the greatest part filled and distended with large quantities of desquamated epithelial cells and blood. As to the origin of these mostly dilapidated cells, I could not decide whether they were mostly or even partly from the glomeruli. The convoluted tubules did not show any defects in the epithelial lining. These masses are apparently dammed up here. The *loops of Henle* and the *straight tubules* have a normal appearance except in Cases III and V, where some of these tubules contain blood. Both these cases were operated upon during profuse bleeding.

In comparing the last two cases with the first three, we have in all of them *diffuse bleeding* into the parenchyma in nearly all parts of the microscopic sections. This is the same in Case IV (stone) and in Case V (supposed stone) as in the other " essential " forms. In all the five cases we further have a marked filling of the convoluted tubules with desquamated epithelial cells. This indicates that this desquamation was a consequence rather than the cause of the colics or of the hæmaturia, and is most probably due to congestion and distention in the kidney. It is not of an infectious or a toxic origin, and thus we can understand the apparent incongruence between the dangerous-looking urinary sediment and the pronounced abnormal findings in the microscopic kidney sections on the one hand, and on the other the small quantity of albumin in the urine and the thorough final clearing up of the cases clinically.

In two of our cases we ran across an occasional obliterated glomerulus. Each of these cases also presented a small focus of infiltration. Case IV was the patient in whom a ureteral stone was with certainty the cause of the kidney changes, and it is in this one that we found the two obliterated glomeruli and the leucocyte focus, which was the size of two glomeruli; while in Case I (painless hæmaturia) we found one obliterated glomerulus and a leucocyte focus of the size of one glomerulus only. The stone case therefore presented the same changes in even a larger degree.

It was a clear aseptic—as far as this goes—ureteral calculus case with obstruction to the urine and overdistention of the kidney and its pelvis. Still we had this focus of leucocyte infiltration. As the kidney is a filter for bacteria (many kinds being expelled with the urine without producing changes in the kidney), it is not difficult to imagine that a pressure in the organ great enough to produce multiple minute hemorrhages in the pelvic mucosa could give rise to some small localized inflammatory foci in the presence of so much microbic material.

Coming back to Case I, of painless hæmaturia, where we also found an obliterated glomerulus and a small area of round-cell infiltration, this may or may not be due to an embolic infective process as pointed out above; it could also be a local inflammatory focus as the *result* of an overcongestion of the kidney.

NOTE.—Suppose that a sudden congestion—be it by obstruction of the ureter or otherwise—can produce such desquamation of cells in the tubules of the kidney and can produce minor inflammatory changes;[1] then a moderate fibrous perinephritis, as often found in these cases, can very well be a further consequence of mild inflammatory foci directly due to injury of the kidney by overdistention; in other words, even the perinephritis could be considered as a result instead of cause. Once established, a perinephritis may be a predisposing factor for further irritation and attacks of congestion by hampering the kidney in evading traumatism.

In other cases a fibrous perinephritis may be secondary to an appendicitis, which latter could even remain unnoticed. The lodge of the right kidney is outlined by a delicate fascia outside of the adipose capsule. The fascia is closed in every direction except downward, where it is widely open and allows free entrance of infectious material from the retrocæcal areolar tissue. In one of the cases of hæmaturia due to acute appendicitis, which Seelig reports in the September number of the ANNALS OF SURGERY, 1908, the infection was found to continue from the appendix through the areolar retrocolic tissue to the kidney lodge. While in this case we have a hæmaturia due to direct continuation of the infection, in other cases of hæmaturia due to acute appendicitis a moderate infectious embolic or toxic condition must be considered. (I have just now a girl of eleven years under observation, where a physician had made the diagnosis of nephritis on account of albumin in the urine, which disappeared, however, promptly after the removal of a subchronically inflamed appendix.)

What an appendicitis can do in this way, other infectious conditions in the body may also produce, and thus we have a pointer for the examination of hæmaturic patients.

Upon a severe congestion the glomeruli seem to answer mainly with hemorrhage, and the convoluted tubules with extensive desquamation. Part of the bulky desquamated masses may well come from the glomerular and capsular epithelia. The whole, being packed together with more or less blood, would be dammed back in the convoluted tubules in front of the tiny Henle loops.

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[1] Sampson (Johns Hopkins Bulletin, Dec., 1903) observed on dogs that staphylococcus cultures injected into the jugular vein only caused infection of the kidney when its ureter had been tied, while otherwise bacteria were to some extent eliminated with the urine. The mildest degrees of infection, however, as we suppose them for our cases, would hardly be looked for in such experiments.

When once the desquamation has started, it is reasonable to think that the retention of a portion of this material increases the swelling of the kidney, and that this makes the perhaps more transitory congestion have a longer lasting effect, producing a hyperæmia with prolonged hemorrhage in one part of the cases, while in the " nephralgia " forms the soreness and tendency to further colics might be caused by such retention.

If we suggest that a congestion was at the bottom of our cases, what brought on this congestion in the first place? It is trauma of which we think first. All the men were of strong, vigorous physique and in the most active years of their life. They were all exposed to hard bodily exercise. In all our cases it was the right kidney which we found to be affected. We know that the right kidney is more exposed to mechanical disturbance than the left one. In addition, in two patients the shortness of the space between the ribs and the crista was noticed.[2]

As special anamnestic data we find, that in Case I the hæmaturia set in in three to five weeks after hurting of the back in lifting. In Case II the first attack of colic came on after a ten hours' ride on horseback. Such per force rides one finds several times mentioned in the literature as an etiological factor for "essential hæmaturia." Case III was a farmer, in whose history, however, no special trauma was known. The last two patients, the one with a ureteral stone and the other with hæmaturia and colics due with reasonable probability to a stone of the ureter, were railroad men. The first one of them described the jarring of the engine in vivid terms. Could a blood-clot have been the first start for the ureteral stone and so the trauma be the cause for the single stone in this individual?

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[2] Brewer found experimentally that not only obstruction of a dog's ureter but also bruising the kidney produced infection.

Was a blood-clot the cause for the hæmaturia and colic in the other case, instead of a suspected kidney stone? And in Case II of the former cases with the "essential colic," was it also a blood-clot that blocked the ureter and thus produced the train of symptoms? But this appears perhaps too one-sided.

To give a few data from the literature I might mention the interesting controversy between Israel and Senator (*Deutsche med. Wochenschr.*, 1902) concerning the explanation of the class of cases under discussion. Israel, leading the way, had published a number of cases, in which he had made nephrotomy with negative macroscopic findings, and had found in some of the cases nephritic changes, which he considered the most frequent cause for the colics and the hæmaturia. Senator contended that this etiology was not sufficiently proven by the cases, in which a microscopic examination with the exception of two cases was missing. He suggested that stones or tuberculosis or small neoplasms, etc., were probably overlooked. Abnormal perinephritic fixation of the kidney he admitted as a very plausible cause. On account of entirely negative findings Senator considered some cases as a localized renal hæmophilia. This theory explains nothing further. Hæmaturia in hæmophiliacs is a different thing. Such cases have been observed and just lately good results are reported in this kind of patients by injections of normal blood serum, as they are now generally recommended in hæmophilic bleeding.

Klemperer had published cases where in apparently healthy kidneys of neuropathic persons copious hemorrhages seemed produced by vasomotor influences.

The earliest and best observed case of renal colic with copious hemorrhages belonging to the group of "essential hæmaturia" was reported by SCHEDE, who performed nephrectomy. He found severe disintegration of the epithelia, especially in Henle's loops. The lumina of the tubuli were filled with detritus. There were a few hyaline casts, now and then calcareous concretions, and fatty degeneration of the epithelium. The most striking were the interstitial changes. All through the whole kidney were foci of partly very recent, partly older, partly quite old interstitial inflammation. Tubuli compressed or cystic. The glomeruli or their remnants in dense connective tissue. Everywhere blood-pigment. Glomerular capsules thickened; their capillaries hyaline bloody masses in the capsular spaces. Desquamation of the capsular epithelia. In the tubules a few blood casts. Slight hyaline degeneration of the blood-vessels and thickening of intima. No micro-organisms.

Dorst (*Centralblatt für innere Med.*, 1903, No. 25, p. 605) reported a case of "pseudo-essential" hæmaturia. Subjective symptoms not marked. With the separator he received clear urine from the right and bloody from the left side. Three long periods of hæmaturia within five years. On operation a chronic hemorrhagic glomerulonephritis was found. A small particle of the kidney had been removed for microscopic examination. Turbid swelling and slight desquamation of the epithelium of the tubuli contorti. Slight hemorrhage in the tubuli recti and some hyaline casts. Two obliterated glomeruli.

This case comes very close to the findings in our cases. However, Dorst considered them more as outspoken inflammatory changes than we do.

P. Wolff of Hamburg (*Muenchen. med. Wochenschr.*, 1903, No. 29) made nephrotomy on a man of 46 years for bleeding from the right kidney. Severe bleeding then necessitated nephrectomy. He found microscopically obliteration of a few marginal glomeruli and moderate signs of irritation as consequence of the manipulation during the nephrotomy. No parenchymatous and interstitial changes. Wolff classes his case as renal hæmaturia without anatomic lesion, of which group he thought only six cases were known up to that time.

This case, too, is very much related to ours. Were the signs of irritation due to the nephrotomy or not? Wolff considers the few obliterated marginal glomeruli as unimportant.

In 1904 H. Schueller (*Wiener klin. Wochenschr.*, Nov. 17) reports a renal hæmaturia in a woman 49 years old. The right kidney is split open, looks normal. Microscopically chronic nephritis.

Illyes (*Deutsche med. Wochenschr.*, 1906, Nov. 10): Nephrotomy for bleeding in a man 44 years old. Microscopically normal tissue.

Taddei (*Morgagni*, 1907, Nov. 13; reported in *Centralblatt f. Chir.*, 1907, Nov. 26): Hæmaturia from the right kidney in a man of 23 years. Nephrectomy. Sclerotic processes on the glomeruli, circumscribed round-cell foci in the cortex, and thickened ureter with alterations of its epithelium led the author to consider the whole as an inflammatory process.

Stienthal (*Beitr. z. klin. Chir.*, Bd. liii, Hft. 3, 1907) claims that up to 1907 there were hardly more than four exactly observed cases of essential hæmaturia on record. He made an incision into the kidney 4 cm. long. Profuse bleeding made him use a tampon in the kidney besides suturing of the organ. Severe bleeding followed and necessitated nephrectomy after five days. Negative microscopic findings.

Milko (*Centralblatt für Chir.*, 1907, No. 49): "Essential Hæmaturia." Already before the operation the patient was nearly bloodless, therefore nephrectomy.

Casper (*Centralblatt f. Chir.*, 1907) reports two cases of chronic double-sided diffuse nephritis which were without symptoms for a long time. No casts nor albumin, but severe and long-lasting hæmaturia from only one kidney. Then two cases of hæmaturia are reported where no nephritis but only smallest changes were found. In both cases œdema of the kidney was noticed as consequence of obstruction of the tubules with blood.

KOTZENBERG (*Med. Klinik*, Nov., 1907; reported in *Centralblatt f. Chir.*, 1908, p. 170): Two cases from the Hamburg-Eppendorf clinic, where severe hemorrhage was thought to be due to tumor and a nephrectomy was made in both cases, but the kidney was afterward found intact. In Case I (man of 60 years), the patient bled to death during the operation. Microscopically both kidneys showed increased leucocytes in the neighborhood of the glomeruli. Epithelium of convoluted tubules was mostly fattily degenerated. Thickened intima in arteries. In Case II, a young man of 18 years, the inspection of the kidney by operation produced a severe hemorrhage and after a few days nephrectomy followed. Then after first improving the patient died six months later from insufficiency of the remaining kidney. The microscopic changes were about the same as in Case I. Kotzenberg thinks that in both cases the cause was a toxic injury to the kidney.

SEELIG (ANNALS OF SURGERY, September, 1908): Three cases of hæmaturia in appendicitis cured after excision of appendix.

RANSOHOFF, in Keen's "Surgery," mentions a case of essential hæmaturia presented by Nickolish to the Paris Academy. In Vienna this kidney had been declared normal; in Paris Albarran and Motz found marked evidences of glomerulonephritis. Ransohoff reports in the same place a case of his own where the glomeruli were generally normal, but in certain areas distinct atrophy with granular changes had occurred. Whether these were marginal glomeruli he does not say. Much blood was microscopically found, both intra- and extravascular. The patient was well after five years.

These few data are given for comparison and not in the idea of having exhausted the literature. Cases reported without microscopic examination were *eo ipso* mostly excluded.

As to the technic of nephrotomy, Israel demands that these kidneys should not be sutured, but simply packed. Suture gave, however, in all our cases very satisfactory results, all the patients walking out of the hospital in two weeks or less, without any urinary discharge from the wound of any account at any time. I do not think that packing of the severely bleeding kidney combined with suturing of it, as Prof. Steinthal did in his case, is as effective as complete suturing. First, the area directly adjoining the pelvis is exactly sutured by a continuous catgut. Some of the largest blood-vessels are found here, especially in the areolar tissue of the calices (arteriæ interlobares, or better, their branches). Fortunately this layer, where the most important suturing is to be done, is the most resistant, and one can quite well use the necessary force in pulling on the continuous suture to secure these vessels. Suturing in this way I have not had any mortality nor any alarming postoperative bleeding. With this same or a second suture we can occlude the vasa arciformia which run parallel to the surface between cortex and medulla. After this the cortex and capsule are approximated with the same continuous catgut thread. If the needle catches now and then the under suture, this interweaving adds to the firmness of closure of the cut vessels. Larger vessels, where seen, are best pierced by the catgut. Figure " 8 " catgut sutures may be used instead of the several layers of continuous suturing. The inner loop then catches the arciform vessels together with the firm tissue at the calices.

A number of authors had to make a nephrectomy later on for continued bleeding after a nephrotomy. The exact suture of the vessels as mentioned above insures us more or less against this and I should not hesitate to make a second nephrotomy with more complete suturing of the kidney, especially in the area of the large vessels, much preferring an organ with numerous infarcted and sclerosed areas to a missing organ. There must always remain uninjured portions enough which, if need should come from insufficiency of the other side, could hypertrophy; and we know that the kidney tissue is very capable of such, as long as it is healthy. In such a sutured kidney there are entirely normal areas to be reckoned with beside the infarcted ones. It is not like a common sclerosed kidney. A second nephrotomy could of course not be done on an individual that has lost too much blood by undue procrastination, and thus again we see that active surgery, if combined with careful judgment, can prove itself to be conservative in the true sense.

General Conclusions.—We cannot be too careful in judging the cases of " essential " hæmaturia and colics; and a long observation is necessary for a somewhat positive diagnosis.

Trauma, among other causes, seems to play a great rôle in the etiology of these cases. The microscopic picture of the urine may show signs of severe kidney irritation, or nothing but blood. The hæmaturia may be lasting for weeks and months, and still there may be no palpable cause found when nephrotomy is performed, except perhaps a few perinephritic bands of adhesion. Yet after operation such a hæmaturia can cease and the kidney can become and remain normal in its function. The renal colic with the most disquieting microscopic appearance of the sediment in the urine of one side can after operation disappear completely, the colic never to return, the urine to remain ideally cleared up.

The microscopic appearance of the kidneys in our cases was a picture which in this group of cases must be frequent, and consists of hemorrhage and epithelial desquamation in the glomeruli, and especially of a distention with desquamated cells and blood in the tubuli contorti. This bleeding and exquisite profuse desquamation is surprisingly free from the signs of a true inflammation, there being no diffuse leucocyte infiltration in the stroma, nor any outspoken turbid swelling of the parenchyma. The lack of such signs of diffuse inflammation is the reason for the possibility of thorough repair, and classes this desquamative process apart from the cases of chronic nephritis. A great sudden passive or active overtension in the kidney can explain such clinical and microscopic pictures, and this is supported by the identical findings in a kidney right after an attack of renal colic due to a ureteral stone.

If treatment, in which prolonged rest, diet, calcium salts, and perhaps serum for the hæmophilia cases play an important rôle, is fruitless, and if eventually ureteral catheterization, which had in some cases a curative effect, was tried, the operation of choice is the nephrotomy, though its serious effect upon a rather extensive area of kidney substance must be kept in mind. Longitudinal splitting of the kidney gives good chance for inspection and good results. Drainage of the kidney itself is as a rule not needed nor advisable. Careful complete catgut suture of the kidney in layers (or by figure "8" sutures) gives very good results. Especial attention must be paid to the suture of the innermost layer. The patients need usually not be in bed any longer than about ten days, and the operative chances are quite good.